

MAGNETIC BEARING ASSEMBLY

FIELD OF THE INVENTION

The present invention is a continuation-in-part application of the
5 parent application bearing Serial No. 09/709,794 and filed on November
10, 2000. The present invention relates to a magnetic bearing assembly,
and more particularly to a magnetic bearing assembly capable of
generating radially and axially repulsive or attractive magnetic fields.

BACKGROUND OF THE INVENTION

10 A bearing is customarily used to support a rotating shaft of a motor
when a rotor rotates around the stator circumferentially.

There are two general types of bearings: a ball bearing and a
self-lubricating bearing.

Please refer to Figs. 1(a) and 1(b). The ball bearing includes an
15 inner ring 13 which includes a groove as a raceway, an outer ring 12
which also includes a groove as a raceway and a plurality of balls 11
which are inserted between respective grooves of the inner and outer
rings. The inner ring 13 is usually fixed to a rotary shaft 21 of a rotor,
and the outer ring 12 is fixed to a base or a stator 23. The upper side of
20 the ball bearing is urged against a spring 22 for facilitating smooth
rotation.

Upon rotating the shaft, the balls of the ball bearing race around the
grooves inward the outer ring 12 and outward the inner ring 13. After
the ball bearing is used for a certain period of time, the fatigue of the
25 metal material is customarily found, thereby causing the balls and the
surface of the inner ring or the outer ring to be abraded.

Referring to Figs. 2(a) and 2(b), a self-lubricating bearing

manufactured of polymeric material is usually in a shape of a sleeve 3 and it contains minute passages or channels carrying therein the lubricating oil 31 such that the oil can be deposited on the shaft 21 by diffusion into the inner wall 32 upon rotation of the shaft 21. The inner
5 wall 32 of the self-lubricating bearing usually contacts with a rotary shaft 21, and the outer wall 33 is fixed to a base 23.

In contrast, the ball bearing can perform under heavy loads and has a long life; however, it is costly and has the disadvantage of being abraded. The self-lubricating bearing has good self-lubricating properties to
10 reduce abrasion and is cheaper than the ball bearing; however, it generally incapable of being operated with large loads and its life is not very long.

It is therefore tried by the present invention to overcome the above-described problems.

15 SUMMARY OF THE INVENTION

It is an object of the present invention to provide a magnetic bearing assembly having an extended lifetime and adapted to be used in a heat-dissipating device such as a cooling fan.

It is further an object of the present invention to provide a magnetic
20 bearing assembly having a low cost.

The magnetic bearing assembly according to the present invention comprises a magnetic portion connected to a shaft and a base for generating a repulsive magnetic field and a bearing portion connected to the shaft and the base for supporting said shaft upon rotation of the shaft.

25 Certainly, the repulsive magnetic field can be one of a radially repulsive magnetic field and an axial repulsive magnetic field.

Preferably, the bearing portion is a sleeve bearing.

Preferably, the base is a stator of a motor.

In an aspect of the present invention, the magnetic portion includes an upper magnetic portion and a lower magnetic portion, wherein the upper magnetic portion and the lower magnetic portion are disposed symmetrically and each includes a first magnetic ring, a second magnetic ring and a third magnetic ring. The first magnetic ring and the third magnetic ring are connected to the shaft, and the second magnetic ring is connected to the base. The second magnetic ring and the third magnetic ring are disposed in a radial alignment with each other to have the same polar disposition. The first magnetic ring and the second magnetic ring are disposed in an axial alignment with each other to have an opposite polar disposition.

In another aspect of the present invention, the magnetic portion includes an upper magnetic portion and a lower magnetic portion, wherein the upper magnetic portion includes an inner magnetic ring and an outer magnetic ring and the lower magnetic portion includes a first magnetic ring, a second magnetic ring and a third magnetic ring. The inner magnetic ring and the outer magnetic ring are disposed in a radial alignment with each other to have the same polar disposition. The first magnetic ring and the third magnetic ring are connected to the shaft and the second magnetic ring is connected to the base. The first magnetic ring, the second magnetic ring and the third magnetic ring are disposed in a radial alignment with each other to have opposite polar disposition.

The above objects and advantages of the present invention will become more readily apparent to those ordinarily skilled in the art after reviewing the following detailed description and accompanying drawings, in which:

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1(a) is a sectional view of a conventional ball bearing;

Fig. 1(b) shows a schematic view for an application of the ball bearing of Fig. 1(a);

5 Fig. 2(a) is a sectional view of a conventional self-lubricating bearing;

Fig. 2(b) shows a schematic view for an application of the self-lubricating bearing of Fig. 2(a);

Fig. 3 is a cross-sectional view of the magnetic bearing assembly applied to a cooling fan according to a first embodiment of the present invention;

10 and

Fig. 4 is a cross-sectional view of the magnetic bearing assembly applied to a cooling fan according to a second embodiment of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

15 Fig. 3 is a schematic diagram of the magnetic bearing assembly applied to a cooling fan according to the first embodiment of the present invention. The magnetic bearing assembly includes a magnetic portion and a bearing portion. The bearing portion is a sleeve bearing 5. The magnetic portion includes an upper magnetic portion constituted by three
20 magnetic rings 51, 52 and 53, and a lower magnetic portion composed of three magnetic rings 511, 521 and 531. In the upper magnetic portion, the first magnetic ring 51 and the third magnetic ring 53 are connected to the base 23 of a frame 4 of the cooling fan and the second magnetic ring 52 is connected to the shaft 21. The second magnetic ring 52 and the
25 third magnetic ring 53 are disposed in a radial alignment, wherein these two rings are assembled with each other to have the same polar disposition for generating the repulsive magnetic field. In addition, the

first magnetic ring 51 and the second magnetic ring 52 are disposed in an axial alignment to have an opposite polar disposition for generating an axially repulsive magnetic field. The radially repulsive magnetic field generated between the second magnetic ring 52 and the third magnetic ring 53, and the axially repulsive magnetic field generated between the first magnetic ring 51 and the second magnetic ring 52 allow to reduce the friction between the sleeve bearing 5 and the shaft 21 upon rotation of the shaft. Likewise, the three magnetic rings 511, 521 and 531 in the lower magnetic portion can effectively reduce the friction between the sleeve bearing 5 and the shaft 21 upon the operation of the cooling fan.

The upper magnetic portion and the lower magnetic portion are symmetrically disposed on both opposite sides of the bearing portion 5 for simultaneously generating the radially and axially repulsive magnetic forces so as to prevent the friction between the sleeve bearing and the shaft, and to obtain the accurate position of the shaft while the cooling fan is rotating.

Fig. 4 is a schematic diagram of the magnetic bearing assembly applied to the cooling fan according to the second embodiment of the present invention. The magnetic bearing assembly includes a magnetic portion and a bearing portion. The bearing portion is a sleeve bearing 5. The magnetic portion includes an upper magnetic portion having an inner magnetic ring 73 and an outer magnetic ring 74, and a lower magnetic portion having three magnetic rings 75, 76 and 77. In the upper magnetic portion, the inner magnetic ring 73 is connected to the shaft 21 and the outer magnetic ring 74 is connected to the base 23 of the frame of the cooling fan. These two magnetic rings 73 and 74 are disposed in a radial alignment with each other to have the same polar

disposition for generating a repulsive magnetic force. In the lower magnetic portion, the first magnetic ring 75 and the third magnetic ring 77 are connected to the shaft 21 and the second magnetic ring is connected to the base 23. These three magnetic rings 75, 76 and 77 are
5 disposed in an axial alignment to have the opposite polar disposition for generating the axially repulsive magnetic forces. Therefore, the friction between the sleeve bearing 5 and the shaft 21 upon the rotation of the cooling fan is considerably reduced.

The upper magnetic portion and the lower magnetic portion are
10 disposed on the opposite sides of the sleeve bearing 5 for respectively generating the radially repulsive magnetic force and the axially repulsive magnetic force at the same time so as to effectively reduce the friction between the sleeve bearing and the shaft.

The magnetic bearing assembly according to the present invention
15 provides the substantially frictionless rotation of the shaft when it is applied to a motor of the cooling fan. Thus, it requires no lubrication, results in less abrasion and produces low noise, all of which contribute to extend the operating life of the bearing. Furthermore, the magnetic rings can be made of plastic magnet for reducing the cost of production
20 and the cost of the magnetic bearing assembly is close to the self-lubricating bearing. Moreover, the aspect of the present invention is not limited to utilize the axially and radially repulsive magnetic force. The attractive magnetic force generated between the magnetic rings can also be applied.

25 While the foregoing has been described in terms of preferred embodiments of the invention, it will be appreciated by those skilled in the art that many variations and modifications may be made without

departing from the principles and spirit of the invention, the scope of which is defined by the appended claims.